APPENDIX A

SAMPLING PLAN

APPENDIX A

OLD ALAMO CREEK FISH COMMUNITY AND HABITAT ASSESSMENT

I. WEBSITES FOR INFORMATION

California Department of Fish and Game (CDFG) Rapid Bioassessment protocols (in pdf format):
http://www.dfg.ca.gov/cabw/protocols.html

U.S. Fish & Wildlife Service Habitat Suitability Indices (in pdf format):
http://www.nwrc.gov/wdb/pub/hsi/hsiindex.htm

II. CREEK REACH DELINEATION INFORMATION

Reach No.	Reach Boundaries	Notes
1	Channel origin in City Park to Leisure Town Road	No flowing water in channel except during winter storm events. Surrounding land use is primarily urban. Small urban drainage and periodic City well discharge inputs create isolated, wetted areas. Insufficient wetted habitat to warrant fish sampling. (Length: couple miles)
2	Leisure Town Road to Kinder-Morgan GW remediation discharge	Surrounding land use is primarily agricultural. Agricultural returns to channel occur downstream of Leisure Town Rd. Isolated, ponded water in channel. Contiguous flow does not occur except during winter storm events. (Length: about 1 mile)
3	Kinder-Morgan GW remediation discharge to EWWTP	Small reaches of wetted channel that typically infiltrate rapidly, creating isolated, disconnected wetted areas within channel. Possible fish sampling location immediately downstream of GW discharge. (Length: about 0.5 mile)
4	EWWTP discharge to Chicorp Lane	First reach of perennial, contiguous flow dominated by EWWTP discharge. No agricultural returns within reach. (Length: about 1 mile)
5	Chicorp Lane to SID Input	Effluent dominated reach, with one or more agricultural returns. Portions channelized. (Length: about 1 mile)
6	SID input to confluence with New Alamo	Channelized reach containing EWWTP effluent, agricultural return waters, SID conveyance water, and stormwater input at Fry Rd. (Length: about 1 mile)

III. FISH SURVEY METHODOLOGY

Electrofishing Survey

Two 100-m fish sampling sites will be selected within each delineated stream reach. Following a reconnaissance survey during which creek reach delineation is finalized and major habitat types (e.g., pools) are noted as to their locations, the 100-m fish sampling sites will be defined to include, to the extent possible, a representative proportion of habitats that exist within the reach. Immediately prior to electrofishing, 0.125-in mesh block nets will be installed across the creek at the downstream and upstream ends of the site in a manner secure enough to prevent fish from entering or leaving the site. Electrofishing will be conducted using a Smith-Root Model 15B or similar backpack electrofishing unit. A minimum of two people will be required to sample fish. One person will operate the backpack electrofishing unit while a second person nets the stunned fish and places them in a bucket or live well. If available, additional crewmembers may provide additional support for fish netting, fish handling, and data recording.

A three-pass depletion method will be used to estimate the number of each fish species present in each site sampled. Each pass will be conducted using a standardized technique to attain equal effort. All sampling will be initiated along the downstream block net. The crew will move upstream in a recurring diagonal pattern from bank to bank, completely covering the area until encountering the upstream block net. Following each pass, the downstream net will be checked for any fish entrained due to electrofishing activities.

Fish Data Analyses

Following each electrofishing pass, the number of each fish species captured will be recorded to facilitate calculating species-specific abundance estimates for each site and sampling event. Other data (e.g., presence of young-of-the-year, general condition, presence of lesions, etc.) will be collected as necessary and appropriate to meet project objectives. This sampling approach will facilitate use of Maximum Likelihood population estimates using MicroFish 3.0 (Van Deventer and Platts 1989) or similar software. Representative voucher specimens of unknown/uncertain species identifications will be retained in 10% formalin solution for subsequent lab identification. Finally, the fish species occurring in Old Alamo Creek will be compared to warm- and coldwater assemblages described by Moyle (1976), Cech et al. (1990), and possibly other sources of such information, for Valley floor creeks of California.

IV. HABITAT ASSESSMENT

CDFG Physical Habitat Quality

Old Alamo Creek is a *low gradient* stream of California's Central Valley; therefore, the following USEPA habitat parameters and criteria for low gradient streams are measured:

1. Epifaunal Substrate/Available Cover
2. Pool Substrate Characterization
3. Pool Variability
4. Sediment Deposition
5. Channel Flow Status
6. Channel Gradient
7. Channel Sinuosity
8. Bank Stability
9. Bank Vegetative Protection
10. Riparian Vegetative Zone Width

USFWS Habitat Suitability Criteria

The USFWS Habitat Suitability Index (HSI) Models for chinook salmon (Raleigh et al. 1986), coho salmon (MacMahon 1983), and steelhead (Raleigh et al. 1984) utilize the following habitat and water quality parameters for habitat assessment various life stages:

1. Maximum, minimum, and average pH
2. Maximum temperature
3. % pools
4. Pool class rating
5. Minimum dissolved oxygen concentrations
6. Average gravel size
7. Average water velocity
8. % fines
9. Average base and peak flows
10. Substrate class
11. % riffle fines
12. Nitrate-nitrogen
13. % instream/substrate cover
14. Average thalweg depth
15. Predominant substrate type
16. Streamside vegetation
17. % canopy/midday shade

Physical habitat at each site will assessed using EPA RBPs (Barbour et al., 1999) for low gradient streams. Ten habitat parameters describing instream habitat, bank, and riparian conditions will be visually assessed and rated on a scale from 0 to 20 with 0 being the poorest habitat and 20 being optimal. A separate fish habitat assessment will be preformed for the development of Habitat Suitability Indices in California for Coho and Chinook salmon and Rainbow and Steelhead trout as per the technical guidance by the US Fish and Wildlife Service. This habitat assessment will measure parameters that are important for the survival, reproduction, and migration of the species mentioned above. These parameters include substrate types, stream velocity, number and class of pools, canopy and riparian vegetation, water chemistry, and available instream habitat.

Substrate will be characterized by performing a modified Wolman pebble count. The pebble count will consist of 10 blind measurements of substrate particle size at 10 transects within the reach. Transects will be distributed proportionally among stream features (e.g. riffle, run, pool). Velocity will be measured using a digital flowmeter at these locations (thalweg and ½ distance from thalweg to each bank) across each modified Wolman Pebble Count transect. Velocity will be measured at 60% depth from the water surface if the total water column depth is less than 2.5 ft. If the total water column depth is greater than 2.5 ft then two measurements will be made, one at 20% depth from water surface and one at 80% depth from water surface. These measurements will then be averaged to obtain an average velocity at that point as per US F&W habitat suitability indices.

The number and class of pools will be assessed visually, i.e., length, width, and depth measurements. Canopy and riparian vegetation will be assessed visually and with the aid of a densiometer, which determines the amount of canopy cover. Four densiometer readings (North, South, East, and West) will be preformed while standing in the thalweg at each of the pebble count transects.

Using a YSI multiprobe, water chemistry will be measured at approximately mid reach, mid-depth upon arriving at the site and again before leaving the site. Water chemistry will be measured twice to determine the rate that the parameters may change with time. Parameters that will be measured include pH, temperature, conductivity, TDS, turbidity, and dissolved oxygen.

V. Benthic Sampling Methods

Benthic macroinvertebrates will be sampled using a semi-quantitative multihabitat approach similar to the EPA Rapid Bioassessment Protocols (RBPs; Barbour et al., 1999). At each site 20-jabs, each 0.5-m in length, will be allocated to all major habitat types in proportion to their representation of the sampling reach. Productive habitats including gravel/cobble, undercut banks and root material, snags/woody debris, and submerged aquatic vegetation will be sampled proportionally (area-based) using a D-frame net (mesh size = 595 Φm) within 100-m stream reaches. Of the 20 total jabs used for the entire benthic collection process, 15 will be allocated to the above habitats. The other five jabs will be allocated to sandy bottom substrate. If the jabs allocated to productive or sandy bottom habitats cannot be used (i.e., these habitats are rare or absent) the remaining jabs will be reallocated to the other habitats found at a site to satisfy the 20-jab requirement for each site.

In the field, benthic samples will be cleaned using a sieve bucket (595 Φm mesh), composited, and examined in white sorting pans. A qualitative evaluation of taxon abundance (class, order, or family level) will be performed on-site. Samples will then be preserved in 80% denatured ethanol, internally and externally labeled (site name, site number, date, samplers, preservative, and QC), and stored for shipment to a Tetra Tech's biological laboratory.

VI. Quality Assurance/Quality Control

For quality assurance/quality control purposes replicate reaches located upstream and directly adjacent to study reaches will be sampled at every site.

Instruments that require calibration (YSI multi-probe, flowmeter) will be calibrated daily and the calibration record will be recorded in the field notebook.

References:

Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling. 1999. Rapid bioassessment protocols for use in streams and wadeable rivers: periphyton, benthic macroinvertebrates and fish, second edition. EPA 841-B-99-002. U.S. Environmental Protection Agency; Office of Water; Washington, D.C.

California Department of Fish and Game (CDFG). 1999. California Stream Bioassessment Procedure. Water Pollution Control Laboratory; Aquatic Bioassessment Laboratory; Rancho Cordova, CA.

Cech, J.J., S.J. Mitchell, D.T. Castleberry, and M. McEnroe. 1990. Distribution of California stream fishes: influence of environmental temperature and hypoxia. Environmental Biology of Fishes 29: 95-105.

MacMahon, T.E. 1983. Habitat suitability index models: coho salmon. U.S. Dept. Int., Fish Wildl. Serv. FWS/OBS-82/10.49. 29 pp.

Moyle, P.B. 1976. Inland fishes of California. University of California Press, Berkeley, California. 405 pp.

Raleigh, R.F., W.J. Miller, and C.P. Nelson. 1986. Habitat suitability index models and instream flow suitability curves: chinook salmon. U.S. Fish Wildl. Serv. Biol. Rep. 82(10.122) 64 pp.

Raleigh, R.F., T. Hickman, R.C. Solomon, and P.C. Nelson. 1984. Habitat suitability information: rainbow trout. U.S. Fish Wildl. Serv. FWS/OBS-82/1060. 64 pp.

Van Deventer, J.S. and W.S. Platts. 1989. Microcomputer software system for generating population statistics from electrofishing data – user's guide for MicroFish 3.0. Gen. Tech. Rep. INT 254. U.S. Dept. of Agriculture, Forest Service, Intermountain Research Station.

Stream Name:	
Station #	
Lat:	Long:
Date:	Initials:

Water Quality			Time (24 hr)	1.)	2.)
pH (su)	1.)	2.)	D.O. (mg/L)	1.)	2.)
Cond.	1.)	2.)	Turbidity	1.)	2.)
TDS	1.)	2.)	Temp. (EC)	1.)	2.)
WQ Instrument:					

Canopy/Cover

% instream cover: _____	Describe: % logs _____ % boulders _____ % undercut banks _____ % overhanging vegetation _____ % other (e.g.) _____
% canopy cover: _____	Describe: % deciduous trees _____ % shrubs _____ % grasses-forbs _____ % conifers _____
% instream shading: _____	% shading should be estimated for amount of shade present between 1000 and 1400 hrs.

Velocity		Instrument:	
Transect	Thalweg velocity (fps)	25% to Left Bank velocity (fps)	25% to Right Bank velocity (fps)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Stream Features

% of Stream Feature	% of Pools in Each Class	Proportion of Pools
Riffles:	First Class Pool:	Total # of Pools:
Run:	Second Class Pool:	# of Pools between 10 - 80 m^3 or
Pools:	Third Class Pool:	50 - 250 m^2 :

First Class Pool: Large and deep. Pool depth and area are sufficient to provide a low velocity resting area for several adult fish. More than 30% of the pool bottom is obscure due to surface turbulence, turbidity, or the presence of structures such as logs, boulders, or overhanging objects. Or, the greatest pool depth is ∃1.5 m in streams #5m wide or ∃2m in streams ∃5m wide.

Second Class Pool: Moderate size and depth. Pool depth and area are sufficient to provide a low velocity resting area for a few adult fish. From 5 to 30% of the bottom is obscured by surface turbulence, turbidity, or the presence of structures. Typical 2^{nd} class pools are large eddies behind boulders and low velocity moderately deep areas beneath overhanging banks and vegetation.

Third Class Pool: Small in area, or shallow, or both. Pool depth and area are sufficient to provide a low velocity resting area for one to very few adult fish. Cover, if present, is in the form of shade, surface turbulence, or very limited structure. Typical 3^{rd} class pools are wide, shallow areas of streams or smaller eddies behind boulders. The entire bottom of the pool may be visible.

FISH DATA SHEET

Stream Name:	Station #:				Date/Time (military):
Location:		Deg.	Min.	Sec.	Form completed by:
	Lat.				Investigators:
	Long.				

Notes:

Fish movement during net installation? _____
Bottom visible in all areas of segment? _____
Same water clarity during multiple passes? _____
Approximate length of segment sampled (m) _____

Electroshocker Charge Info		
Anodes/Unit	Unit 1 (gray)	Unit 2 (green)
Begin 1st pass		
Begin 2nd pass		
End 2nd pass		

SPECIES	**Number Kept/Photo**	**1st Pass Catch (total)**	**2nd Pass Catch (total)**	**Anomalies?**	**Comments**

FISH CRIB SHEET

_____ Pass			_____ Pass		
Species	**Tally**	**Anomalies**	**Species**	**Tally**	**Anomalies**

Comments:

Stream Name:	Station #:				Date/Time (military):
Location:		Deg.	Min.	Sec.	Form completed by:
	Lat.				Investigators:
	Long.				

Water Quality Instrument:			Time (24 hr)	1)	2)
pH (su)	1)	2)	D.O. (mg/L)	1)	2)
Cond. (Φs/cm)	1)	2)	Turbidity (NTU)	1)	2)
TDS (mg/L)	1)	2)	Temp. (EC)	1)	2)

Velocity/Cover Instruments: Velocity _____Cover_____

Tran-sect	Thalweg		½ from thalweg to Left Bank		½ from thalweg to Right Bank		% Cover facing each direction.			
	Depth (ft)	Velocity (ft/s)	Depth (ft)	Velocity (ft/s)	Depth (ft)	Velocity (ft/s)	North	South	East	West
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Extra										

If depth is more than 2.5 ft, measure velocity at 20 and 80%. If less than 2.5 measure velocity at 60%.

Stream Features (Visual Estimate)

% of Stream Feature	% of Pools in Each Class (= 100%)	Proportion of Pools
Riffles:	First Class Pool:	Total # of Pools:
Run:	Second Class Pool:	# of Pools between 10 - 80 m^3 or 50 - 250 m^2 :
Pools:	Third Class Pool:	

First Class Pool: Large and deep. Pool depth and area are sufficient to provide a low velocity resting area for several adult fish. More than 30%

of the pool bottom is obscure due to surface turbulence, turbidity, or the presence of structures such as logs, boulders, or overhanging objects. Or, the greatest pool depth is ∃1.5 m in streams #5m wide or ∃2m in streams ∃5m wide.

Second Class Pool: Moderate size and depth. Pool depth and area are sufficient to provide a low velocity resting area for a few adult fish. From 5 to 30% of the bottom is obscured by surface turbulence, turbidity, or the presence of structures. Typical 2nd class pools are large eddies behind boulders and low velocity moderately deep areas beneath overhanging banks and vegetation.

Third Class Pool: Small in area, or shallow, or both. Pool depth and area are sufficient to provide a low velocity resting area for one to very few adult fish. Cover, if present, is in the form of shade, surface turbulence, or very limited structure. Typical 3rd class pools are wide, shallow areas of streams or smaller eddies behind boulders. The entire bottom of the pool may be visible.

Canopy/Cover (Visual Estimate)	
% instream habitat: (May not equal 100%)	Describe: % woody debris (Should add up % boulders to 100%) % undercut banks % overhanging vegetation % other ( )
% riparian zone: (May not equal 100%)	Describe: % deciduous trees (Should add up % shrubs to 100%) % grasses-forbes % conifers % other ( )
% instream shading:	% shading should be estimated for amount of shade present between 1000 and 1400 hrs.

Photo Log	
#	Description

Map Key

	Flag Position	…	Run	11	Eroded Bank
	GPS Position		Pool		Macrophyte
!	Velocity Measurement	——	Transect Line		Shrubs
9	Flow Direction		Hydrochemistry	///////	Grasses/Forbes
XXX	Snag/Woody Debris		Sand		Coniferous Tree
‡‡‡	Undercut Bank		Gravel		Deciduous Tree
G	Random Boulder		Cobble		Animal
⊠	Riprap		Concrete channel	–	Building
	Fish	• • • • • •	Deposition		

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION	
STATION #_____	STREAM CLASS	
LAT _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME	REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Habitat	**Condition Category**			

Parameter	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME:	**STATION#**				**DATE/TIME (military):**
LOCATION:		Deg.	Min.	Sec.	Form completed by:
	Lat.				Investigators:
	Long.				

HABITAT TYPES	**Indicate the percentage of each habitat type present** □ Cobble_____% □ Snags_____% □ Vegetated Banks_____% □ Sand_____% □ Submerged Macrophytes_____% □ Other ( )_____%
SAMPLE COLLECTION	**Gear used** □ D-frame □ kick-net □ Other _____ **How were the samples collected?** □ wading □ from bank □ from boat **Indicate the number of jabs/kicks taken in each habitat type.** □ Cobble_____ □ Snags_____ □ Vegetated Banks_____ □ Sand_____ □ Submerged Macrophytes_____ □ Other ( )_____
GENERAL COMMENTS	

QUALITATIVE LISTING OF AQUATIC BIOTA
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3= Abundant, 4 = Dominant

Periphyton	0	1	2	3	4	Slimes	0	1	2	3	4
Filamentous Algae	0	1	2	3	4	Macroinvertebrates	0	1	2	3	4
Macrophytes	0	1	2	3	4	Fish	0	1	2	3	4

FIELD OBSERVATIONS OF MACROBENTHOS

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3= Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0	1	2	3	4	Anisoptera	0	1	2	3	4	Chironomidae	0	1	2	3	4
Hydrozoa	0	1	2	3	4	Zygoptera	0	1	2	3	4	Ephemeroptera	0	1	2	3	4
Platyhelminthes	0	1	2	3	4	Hemiptera	0	1	2	3	4	Trichoptera	0	1	2	3	4
Turbellaria	0	1	2	3	4	Coleoptera	0	1	2	3	4	Other	0	1	2	3	4
Hirudinea	0	1	2	3	4	Lepidoptera	0	1	2	3	4						
Oligochaeta	0	1	2	3	4	Sialidae	0	1	2	3	4						
Isopoda	0	1	2	3	4	Corydalidae	0	1	2	3	4						
Amphipoda	0	1	2	3	4	Tipulidae	0	1	2	3	4						
Decapoda	0	1	2	3	4	Empididae	0	1	2	3	4						
Gastropoda	0	1	2	3	4	Simuliidae	0	1	2	3	4						
Bivalvia	0	1	2	3	4	Tabinidae	0	1	2	3	4						
						Culcidae	0	1	2	3	4						

PEBBLE COUNT FIELD DATA SHEET

Stream Name:	Station #:				Date/Time (military):
Location:		Deg.	Min.	Sec.	Form completed by:
	Lat.				Investigators:
	Long.				

Field Measurement			Grabs									
m	**Transect**	**Feature Type**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
	1											
	2											
	3											
	4											
	5											
	6											
	7											
	8											
	9											
	10											

Abbreviations:

Silt/Clay = SC
Sand - Very Fine = VF
Sand - Fine = F
Sand - Medium = M
Sand - Coarse = C
Rip Rap =RR
Gabion =G
Earthen Burm =EB
Hard Pan Clay =HP
Sand - Very Coarse = VC
Bedrock = B

Feature Types:

Riffle
Run
Glide
Pool

The top table is completed in the field. The bottom table is used for Data Entry and QA/QC.

Size Class		Size (mm)	Feature	Number	Feature	Number	Feature	Number	Total (for all features)	Cumulative Total (for all sizes)
Silt/Clay		< 0.062								
Sand	Very Fine	0.062-0.125								
	Fine	0.125-0.25								
	Medium	0.25-0.50								
	Coarse	0.50-1.0								
	Very Coarse	1.0-2.0								
Gravel	Very Fine	2-4								
	Fine	4-6								
		6-8								
	Medium	8-12								
		12-16								
	Coarse	16-24								
		24-32								
	Very Coarse	32-48								
		48-64								
Cobble	Small	64-96								
		96-128								
	Large	128-192								
		192-256								
Boulder	Small	256-384								
		384-512								
	Medium	512-1024								
	Large - Very Large	1024-4096								
Bedrock		> 4096								

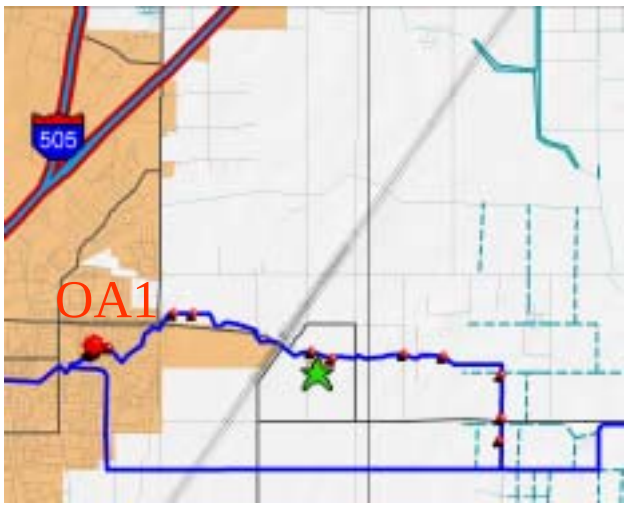
APPENDIX B

SITE DESCRIPTIONS

OA1

Latitude	38°20’49.9”
Longitude	121°56’48.6”

OA-1 is about 200 m upstream of the bridge at Christine Road. The channel was full during the winter sampling due to recent rainfall. Physical habitat scored an average 101(50.5% of 200). The substrate was dominated by silt/clay.



Pebble Count

100% Silt/Clay

Habitat Parameter	Average Score
Epifaunal substrate -	11
Pool substrate characterization -	8
Pool variability -	8
Sediment Deposition -	7
Channel flow -	8
Channel Alteration -	15
Channel Sinuosity -	8
Bank Stability -	RB 5.5 LB 6
Vegetative protection -	RB 6.5 LB 7
Riparian zone width -	RB5 LB 6

Stream Features

Summer		Winter
0%	Riffles	0%
75%	Runs	0%
25%	Pools	100%

OA2

Latitude 38º 20’53.3”

Longitude 121º56’47.5”

OA2 is located approximately 100 m upstream of the Christine Road bridge. Water accumulated from a recent rain, but was ponded. Physical habitat scored an average 101(50.5% of 200). Pebble count data revealed that bottom substrate was entirely silt/clay.

Pebble Count
100% Silt/Clay

Habitat Parameter	Average Score
Epifaunal substrate -	11
Pool substrate characterization -	8
Pool variability -	8
Sediment Deposition -	7
Channel flow -	8
Channel Alteration -	15
Channel Sinuosity -	8
Bank Stability -	RB 7.5 LB 4
Vegetative protection -	RB 7.5 LB 6
Riparian zone width -	RB 8 LB 3

Stream Features		
Summer		Winter
0%	Riffles	0%
75%	Runs	0%
25%	Pools	100%

OA3

Latitude 38°21’11.05”

Longitude 121°55’37.3”

OA 3 is located on Old Alamo Creek, near the intersection of Hawkins and Leisuretown Roads. Stormwater was collected and pooled in the channel, with no flow. Physical habitat score averaged 89.5 (45% of 200). According to the pebble count, the channel was composed entirely of silt/clay.

Pebble Count
100% Silt/Clay

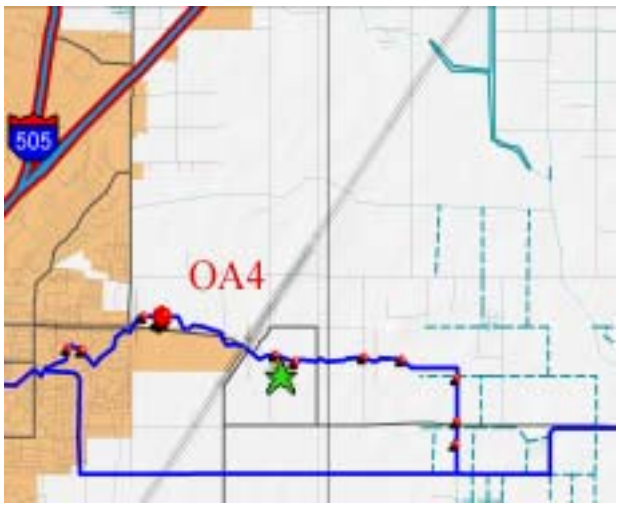
Stream Features		
Summer		Winter
0%	Riffles	0%
0%	Runs	0%
100%	Pools	100%

Habitat Parameter	Average Score
Epifaunal substrate -	9.5
Pool substrate characterization -	8
Pool variability -	8
Sediment Deposition -	9
Channel flow -	11
Channel Alteration -	11
Channel Sinuosity -	3
Bank Stability -	RB 6.5 LB 6.5
Vegetative protection -	RB 6 LB 6
Riparian zone width -	RB 3 LB 3

OA4

Latitude	38°21’11.16”
Longitude	121°55’31.26”

OA4 is located approximately 200 m DS of OA3. The site was surrounded by tall grasses. Few trees made up a relatively narrow riparian zone, with fields on either side, and a farm road on the left bank. Physical habitat scored an average 94 (47% of 200). Trash, including bags, diapers, and bottles littered the site. The stream bed was composed entirely of silt/clay.



Pebble Count
100% Silt/Clay

Stream Features		
Summer		Winter
0%	Riffles	0%
0%	Runs	0%
100%	Pools	100%

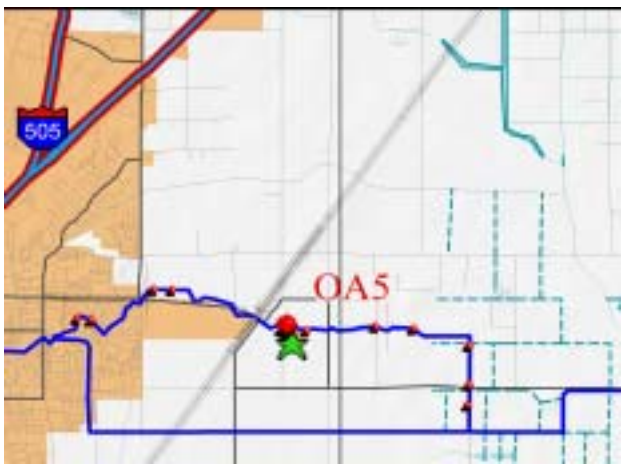
Habitat Parameter	Average Score
Epifaunal substrate -	9.5
Pool substrate characterization -	9
Pool variability -	9
Sediment Deposition -	9.5
Channel flow -	11
Channel Alteration -	11
Channel Sinuosity -	3.5
Bank Stability -	RB 6 LB 7
Vegetative protection -	RB 5 LB 7
Riparian zone width -	RB 2 LB 4.5

OA5

Latitude 38°20’50.1”

Longitude 121°54’17.6”

OA5 is downstream of Vaca Station Road, at the Easterly Wastewater Treatment Plant (EWWTP), just upstream of the old outfall. There is a field on the left bank, and dry grass and a few tress on the right bank, before a gravel road that runs parallel to the stream along EWWTP property. Physical habitat scored an average 85 (43% of 200). Pebble count revealed the entire channel was composed of silt/clay.



Pebble Count
100% Silt/Clay

Stream Features		
Summer		Winter
0%	Riffles	0%
80%	Runs	0%
20%	Pools	100%

Habitat Parameter	Average Score
Epifaunal substrate -	8.5
Pool substrate characterization -	7.5
Pool variability -	5
Sediment Deposition -	5.5
Channel flow -	12.5
Channel Alteration -	9.5
Channel Sinuosity -	5.5
Bank Stability -	RB 6.5 LB 6
Vegetative protection -	RB 6.5 LB 6
Riparian zone width -	RB 3.5 LB 2.5

OA6

Latitude 38º20’46.3”

Longitude 121º54’02.7”

OA6 is downstream of OA5, but still runs along the EWWTP. This site was similar to OA5, with the addition of some bushes along the right bank. Physical habitat was scored in January only, with 107(53.5% of 200). The majority of the channel (80%) was composed of silt/clay with fine sand being the other 20%.

Pebble Count
80% Silt/Clay
20% Fine Sand

Stream Features		
Summer		Winter
NM	Riffles	0%
NM	Runs	80%
NM	Pools	20%

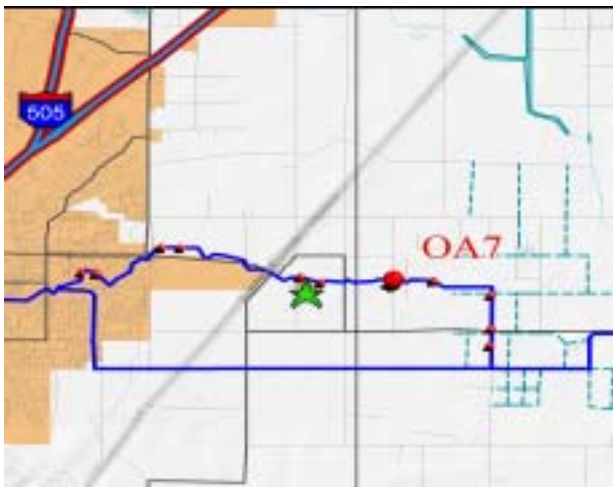
Habitat Parameter	Average Score
Epifaunal substrate -	12
Pool substrate characterization -	11
Pool variability -	11
Sediment Deposition -	7
Channel flow -	18
Channel Alteration -	10
Channel Sinuosity -	6
Bank Stability -	RB 6 LB 6
Vegetative protection -	RB 7 LB 7
Riparian zone width -	RB 4 LB 2

OA7

Latitude 38°20’48.9”

Longitude 121°52’21.69”

OA7 is downstream of the Fry/Lewis Road intersection, off the first farm road. OA7 has a narrow riparian zone of tall grasses and trees, with fields on either side. There were many downed trees and woody debris in the stream channel. Physical habitat average score was 102 (51% of 200). Pebble count revealed that the majority of the channel is composed of silt/clay (47%) and medium sand (40%).



Pebble Count
80% Silt/Clay
20% Fine Sand

Stream Features		
Summer		Winter
0%	Riffles	0%
75%	Runs	70%
25%	Pools	30%

Habitat Parameter	Average Score
Epifaunal substrate -	15.5
Pool substrate characterization -	8
Pool variability -	8.5
Sediment Deposition -	8
Channel flow -	17.5
Channel Alteration -	12.5
Channel Sinuosity -	5
Bank Stability -	RB 4 LB 4
Vegetative protection -	RB 4.5 LB 4.5
Riparian zone width -	RB 5 LB 5

OA8

Latitude 38°20’49.45”

Longitude 121°58’0.49”

OA8 is approximately ¼ mile downstream of Chicorps Lane. There were trees, grasses, and shrubs along both banks, however the riparian zone width was relatively narrow. The physical habitat average score was 98.5 (49% of 200), while pebble the pebble count illustrated that the channel was composed of fine sand (80%) and silt/clay (20%).

Pebble Count
20% Silt/Clay
80% Fine Sand

Stream Features		
Summer		Winter
0%	Riffles	0%
65%	Runs	60%
35%	Pools	40%

Habitat Parameter	Average Score
Epifaunal substrate -	14.5
Pool substrate characterization -	9
Pool variability -	10
Sediment Deposition -	5
Channel flow -	17
Channel Alteration -	10.5
Channel Sinuosity -	3
Bank Stability -	RB 5 LB 5.5
Vegetative protection -	RB 6.5 LB 7
Riparian zone width -	RB 3 LB 2.5

OA9

Latitude 38°20’39.58”

Longitude 121°52’10.84”

OA9 runs perpendicular to Dally Road, and is located just past where the stream bends at a culvert. The riparian zone is narrow with trees and tall grasses. On either side of the stream there are fields, and a field road runs along the left bank. Average physical habitat scored 68 (34% of 200). Pebble count data showed the channel was composed of fines (silt/clay and sands).

Pebble Count
68% Silt/Clay
30% Medium sand
2% Very coarse sand

Stream Features		
Summer		Winter
0%	Riffles	0%
90%	Runs	90%
10%	Pools	10%

Habitat Parameter	Average Score
Epifaunal substrate -	4.5
Pool substrate characterization -	6.5
Pool variability -	6
Sediment Deposition -	5
Channel flow -	18
Channel Alteration -	6
Channel Sinuosity -	2
Bank Stability -	RB 3.5 LB 4
Vegetative protection -	RB 4.5 LB 4.5
Riparian zone width -	RB 1.5 LB 2

OA10

Latitude 38°20’27.96”

Longitude 121°52’9.12”

OA10 is upstream of the bridge at the intersection of Dally and Fry Roads. Trimmed grasses and one tree make up the thin riparian zone. Dally Road runs parallel to the stream along the right bank. Average physical habitat scored a 63.5 (32% of 200). From this point to the confluence with New Alamo Creek, Old Alamo Creek is channelized. The channel is comprised of silt/clay with submerged macrophytes throughout.

Pebble Count

100% Silt/Clay

Stream Features

Summer		Winter
0%	Riffles	0%
100%	Runs	100%
0%	Pools	0%

Habitat Parameter	Average Score
Epifaunal substrate -	6
Pool substrate characterization -	6
Pool variability -	2
Sediment Deposition -	5.5
Channel flow -	14.5
Channel Alteration -	8
Channel Sinuosity -	1.5
Bank Stability -	RB 4.5 LB 3.5
Vegetative protection -	RB 4.5 LB 3.5
Riparian zone width -	RB 2.5 LB 1.5

OA11

Latitude 38°20’9.92”

Longitude 121°52’9.3”

OA11 is downstream of the bridge at the intersection of Dally and Fry Roads. Trimmed grasses make up the thin riparian zone. Trimmed grasses and a field run along the left bank, while gravel mixed with trimmed grasses is along the right bank. Average physical habitat score was 60 (30% of 200). Pebble count revealed that the stream was mostly silt/clay, with some gravel and boulders.

Pebble Count

86% Silt/Clay

12% Very fine gravel

2% Medium boulder

Stream Features

Summer		Winter
0%	Riffles	0%
>95%	Runs	100%
<5%	Pools	0%

Habitat Parameter	Average Score
Epifaunal substrate -	7.5
Pool substrate characterization -	9.5
Pool variability -	4.5
Sediment Deposition -	6
Channel flow -	17
Channel Alteration -	5
Channel Sinuosity -	0.5
Bank Stability -	RB 1 LB 2
Vegetative protection -	RB 2 LB 2
Riparian zone width -	RB 1 LB 2

APPENDIX C

HSI TABLES

Table C-1. Data and Suitability indices (SI's) for Rainbow trout habitat variables for Old Alamo Creek.

Variables		OA1		OA2		OA3		OA4		OA5		OA6	
		Data	SI	Data	SI	Data	SI	Data	SI	Data	SI	Data	SI
V1	Max. temperature	25.22	0	25.22	0	25.22	0	25.22	0	25.22	0	25.22	0
V2	Max. temperature	24.75	0	24.75	0	24.75	0	24.75	0	24.75	0	24.75	0
V3	Min. dissolved oxygen	3.9	0	3.9	0	3.9	0	3.9	0	3.9	0	3.9	0
V4	Ave. depth	0	0	0	0	66.8	1	66.8	1	29.4	0.6	41.0	1
V5	Ave. velocity	0	0	0	0	0	0	0	0	3.43		NA	1[A]
V6	% cover	60	1	80	1	80	1	100	1	60	1	70	1
V7	Ave. gravel size	<0.062	0	<0.062	0	<0.062	0	<0.062	0	<0.062	0	<0.062	0
V8	Predom. Substrate size	0	0	0	0	0	0	0	0	0	0	0	0
V9	Predom. Substrate type	C	0.3	C	0.3	C	0.3	C	0.3	C	0.3	C	0.3
V10	% pools	25	0.8	25	0.8	100	0.5	100	0.5	20	0.7	20	0.8
V11	% streamside vegetation	96.25	0.75	120	1	112.5	0.95	105.75	0.9	130	1	121.5	1
V12	% bank vegetation	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]
V13	Max. pH	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]
V13	Min. pH	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]
V14	% average base flow	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]
V15	Pool class rating	C	0.3	C	0.3	C	0.3	C	0.3	C	0.3	B	0.6
V16	% fines (A)	100	0	100	0	100	0	100	0	100	0	100	0
V16	% fines (B)	100	0	100	0	100	0	100	0	100	0	100	0
V17	% midday shade	70	1	80	0.95	80	0.95	85	0.9	90	0.8	85	0.9
V18	% average daily flow	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]

[A] Variable not assessed, SI assumed to be 1 for analysis purposes.

Table C-1 . continued.

Variables		OA7		OA8		OA9		OA10		OA11	
		Data	SI	Data	SI	Data	SI	Data	SI	Data	SI
V1	Max. temperature	25.22	0	25.22	0	25.22	0	25.22	0	25.22	0
V2	Max. temperature	24.75	0	24.75	0	24.75	0	24.75	0	24.75	0
V3	Min. dissolved oxygen	3.9	0	3.9	0	3.9	0	3.9	0	3.9	0
V4	Ave. depth	60.2	1	55.3	1	44.1	1	42.9	1	40.4	1.0
V5	Ave. velocity	27.1	0.9	26.4	0.9	27.8	0.9	14.9	0.4	21.9	0.6
V6	% cover	25	1	40	1	30	1	30	1	30	1
V7	Ave. gravel size	0.1875	0	0.0935	0	<0.062	0	<0.062	0	<0.062	0
V8	Predom. Substrate size	0	0	0	0	0	0	0	0	0	0
V9	Predom. Substrate type	C	0.3	C	0.3	C	0.3	C	0.3	C	0.3
V10	% pools	30	0.9	40	1	10	0.4	0	0.3	0	0.3
V11	% streamside vegetation	78.75	0.6	108	0.8	108	0.8	75	0.58	75	0.58
V12	% bank vegetation	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]
V13	Max. pH	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]
V13	Min. pH	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]
V14	% average base flow	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]
V15	Pool class rating	B	0.6	B	0.6	B	0.6	C	0.3	C	0.3
V16	% fines (A)	100	0	100	0	100	0	100	0	98	0
V16	% fines (B)	100	0	100	0	100	0	100	0	98	0
V17	% midday shade	90	0.8	80	0.95	30	0.75	0	0.3	0	0.3
V18	% average daily flow	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]

[A] Variable not assessed, SI assumed to be 1 for analysis purposes.

Table C-2. Species Suitability indices (SI) and component SI's for rainbow trout at Old Alamo Creek.

Component	OA1	OA2	OA3	OA4	OA5	OA6	OA7	OA8	OA9	OA10	OA11
Adult (C_A)											
Juvenile (C_j)											
Fry (C_F)											
Embryo (C_E)											
Other (C_o)											
Overall HSI $(C_A \times C_J \times C_F \times C_E \times C_o)^{1/N}$											
Presence/Absence HSI $(C_A \times C_J \times C_o)^{1/N}$											

Table C-3. Species Suitability indices (SI) and component SI's for Steelhead trout at Old Alamo Creek.

Component	OA1	OA2	OA3	OA4	OA5	OA6	OA7	OA8	OA9	OA10	OA11
Adult (C_A)											
Juvenile (C_j)											
Fry (C_F)											
Embryo (C_E)											
Other (C_o)											
Overall HSI $(C_A \times C_J \times C_F \times C_E \times C_o)^{1/N}$											
Presence/Absence HSI $(C_A \times C_J \times C_o)^{1/N}$											

Table C-4. Suitability indices (SI) and data for Coho salmon habitat variables for Old Alamo Creek sites.

Variables		OA1		OA2		OA3		OA4		OA5		OA6	
		Data	SI	Data	SI	Data	SI	Data	SI	Data	SI	Data	SI
V1	Temp. during upstream migration	25.2	0	25.2	0	25.2	0	25.2	0	25.2	0	25.2	0
V2	D.O. during upstream migration	3.9	0	3.9	0	3.9	0	3.9	0	3.9	0	3.9	0
V3	Temp. – incubation	21.24	0	21.24	0	21.24	0	21.24	0	21.24	0	21.24	0
V4	D.O. – incubation	5.4	0.3	5.4	0.3	5.4	0.3	5.4	0.3	5.4	0.3	5.4	0.3
V5	Substrate Composition (A,B)	A=0; B=100	0	A=0; B=100	0	A=0; B=100	0	A=0; B=100	0	A=0; B=100	0	A=0; B=100	0
V6	Temp. during rearing	25.2	0	25.2	0	25.2	0	25.2	0	25.2	0	25.2	0
V7	D.O. during rearing	3.9	0.05	3.9	0.05	3.9	0.05	3.9	0.05	3.9	0.05	3.9	0.05
V8	Percent canopy	90.5	0.75	80.8	0.9	80.8	0.9	88.2	0.8	70.2	1	74.2	1
V9	Vegetation composition of riparian zone	87.5	0.4	80	0.38	135	0.9	148.5	0.95	180	1	153	0.99
V10	Percent pools	100	0.2	100	0.2	100	0.2	100	0.2	100	0.2	20	0.2
V11	Proportion of pools	0	0.2	0	0.2	0	0.2	0	0.2	0	0.2	100	1
V12	Percent cover	NA	1[A]	NA	1[A]	30	0.8	30	0.8	30	0.8	70	1
V13	Winter cover	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]
V14	Temp. during parr-smolt transformation and seaward migration	A. 19.9 B. 25.2	0	A. 19.9 B. 25.2	00	A. 19.9 B. 25.2	0	A. 19.9 B. 25.2	0	A. 19.9 B. 25.2	0	A. 19.9 B. 25.2	0
V15	D.O. during seaward migration	3.9	0.05	3.9	0.05	3.9	0.05	3.9	0.05	3.9	0.05	3.9	0.05
HSI			0		0		0		0		0		0

[A] Variable not assessed, SI assumed to be 1 for analysis purposes.

Table C-4. Continued.

Variables		OA7		OA8		OA9		OA10		OA11	
		Data	SI	Data	SI	Data	SI	Data	SI	Data	SI
V1	Temp. during upstream migration	25.2	0	25.2	0	25.2	0	25.2	0	25.2	0
V2	D.O. during upstream migration	3.9	0	3.9	0	3.9	0	3.9	0	3.9	0
V3	Temp. – incubation	21.24	0	21.24	0	21.24	0	21.24	0	21.24	0
V4	D.O. – incubation	5.4	0	5.4	0	5.4	0	5.4	0	5.4	0
V5	Substrate Composition (A,B)	A=0; B=100	0	A=0; B=100	0	A=0; B=100	0	A=0; B=100	0	A=0; B=98	0
V6	Temp. during rearing	25.2	0	25.2	0	25.2	0	25.2	0	25.2	0
V7	D.O. during rearing	3.9	0.05	3.9	0.05	3.9	0.05	3.9	0.05	3.9	0.05
V8	Percent canopy	89.5	0.75	66	1	46.4	0.95	0.45	0.95	0	0.2
V9	Vegetation composition of riparian zone	122.5	0.8	162	1	104	0.7	50	0.2	50	0.2
V10	Percent pools	25	0.3	35	0.8	10	0.15	0	0.1	0	0.1
V11	Proportion of pools	100	1	100	1	100	1	0	0.2	0	0.2
V12	Percent cover	75	1	60	1	35	1	40	1	60	1
V13	Winter cover	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]
V14	Temp. during parr-smolt transformation and seaward migration	A. 19.9 B. 25.2	0	A. 19.9 B. 25.2	0	A. 19.9 B. 25.2	0	A. 19.9 B. 25.2	0	A. 19.9 B. 25.2	0
V15	D.O. during seaward migration	3.9	0.05	3.9	0.05	3.9	0.05	3.9	0.05	3.9	0.05
HSI			0		0		0		0		0

[A] Variable not assessed, SI assumed to be 1 for analysis purposes.

Table C-5. Suitability indices (SI) and data for Chinook salmon habitat variables for Old Alamo Creek sites.

Variables		OA1		OA2		OA3		OA4		OA5		OA6	
		Data	SI	Data	SI	Data	SI	Data	SI	Data	SI	Data	SI
V1	pH (su)	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]
V2	Maximum Temperature	25.22	0	25.22	0	25.22	0	25.22	0	25.22	0	25.22	0
V3	Minimum DO	5.4	0.1	5.4	0.1	5.4	0.1	5.4	0.1	5.4	0.1	5.4	0.1
V4	% pools	100	0.2	100	0.2	100	0.2	100	0.2	100	0.2	20	0.5
V5	Pool Class	C	0.3	C	0.3	C	0.3	C	0.3	C	0.3	C	0.3
V6	Maximum Temp. (embryo)	20.6	0	20.6	0	20.6	0	20.6	0	20.6	0	20.6	0
V7	Max. or Min. Temp. (embryo)[b]	20.6; 17.2	0	20.6; 17.2	0	20.6; 17.2	0	20.6; 17.2	0	20.6; 17.2	0	20.6; 17.2	0
V8	Average substrate size (embryo)	A=0; B=0	0	A=0; B=0	0	A=0; B=0	0	A=0; B=0	0	A=0; B=0	0	A=0; B=0	0
V9	Average water velocity (embryo)	0	0	0	0	0	0	0	0	0	0	55.43	1
V10	% fines (embryo)	A=100; B=0	0	A=100; B=0	0	A=100; B=0	0	A=100; B=0	0	A=100; B=0	0	A=100; B=0	0
V11	Average base flow	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]
V12	Average peak flow	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]
V13	Substrate class	C	0.3	C	0.3	C	0.3	C	0.3	C	0.3	C	0.3
V14	% riffle-run fines	100	0	100	0	100	0	100	0	100	0	100	0
V15	Nitrate-N Concentration	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]
V16	% cover	NA	1[A]	NA	1[A]	30	1	30	1	30	1	30	1
V17	Substrate cover	0	0	0	0	0	0	0	0	0	0	0	0
HSI			0		0		0		0		0		0

[A] Variable not assessed, SI assumed to be 1 for analysis purposes.

Table C-5. Continued.

Variables		OA7		OA8		OA9		OA10		OA11	
		Data	SI	Data	SI	Data	SI	Data	SI	Data	SI
V1	pH (su)	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]
V2	Maximum Temperature	25.22	0	25.22	0	25.22	0	25.22	0	25.22	0
V3	Minimum DO	5.4	0.1	5.4	0.1	5.4	0.1	5.4	0.1	5.4	0.1
V4	% pools	25	0.8	35	0.9	10	0.25	0	0.2	0	0.2
V5	Pool Class	B	0.6	B	0.6	C	0.3	C	0.3	C	0.3
V6	Maximum Temp. (embryo)	20.6	0	20.6	0	20.6	0	20.6	0	20.6	0
V7	Max. or Min. Temp. (embryo)[b]	20.6, 17.2	0	20.6, 17.2	0	20.6, 17.2	0	20.6, 17.2	0	20.6, 17.2	0
V8	Average substrate size (embryo)	A=0, B=0	0	A=0; B=0	0	A=0; B=0	0	A=0; B=0	0	A=0; B=14	0
V9	Average water velocity (embryo)	76.67	1	38.91	1	87.84	0.85	75.01	1	75.59	1
V10	% fines (embryo)	A=100; B=0	0	A=100; B=0	0	A=98; B=2	0	A=100; B=0	0	A=86; B=12	0
V11	Average base flow	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]
V12	Average peak flow	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]
V13	Substrate class	C	0.3	C	0.3	C	0.3	C	0.3	C	0.3
V14	% riffle-run fines	100		100		100		100		98	
V15	Nitrate-N Concentration	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]	NA	1[A]
V16	% cover	25	1	40	1	30	1	30	1	30	1
V17	Substrate cover	0	0	0	0	0	0	0	0	0	0
HSI			0		0		0		0		0

[A] Variable not assessed, SI assumed to be 1 for analysis purposes.

American Shad

Spawning Adult

C_{el} = SI of V3

C_J = lower variable SI of V4 or V5

Site	C_A	C_{el}	C_J
HD1	0.5	1	NC
HD2	0	1	NC
OA1	0	1	NC
OA2	0	1	NC
OA3	0	1	NC
OA4	0	1	NC
OA5	0	1	NC
OA6	1	1	NC
OA7	1	1	NC
OA8	0.8	1	NC
OA9	1	1	NC
OA10	1	1	NC
OA11	1	1	NC

Striped Bass

Adult NC

Spawning $C_S = (V_1 \times V_2 \times V_3)^{1/3}$

Egg $C_E = (V_3 \times V_4 \times V_5)^{1/3}$ if $V_3 < V_4$ and V_5; but if $V_3 > V_4$ and V_5, then $C_E = V_4$ or V_5, which is lowest.

Larval NC

Juvenile NC

Site	C_A	C_S	C_E	C_L	C_J
HD1	NC	0	0	NC	NC
HD2	NC	0.67	0	NC	NC
OA1	NC	0.67	0	NC	NC
OA2	NC	0.67	0	NC	NC
OA3	NC	0.67	0	NC	NC
OA4	NC	0.67	0	NC	NC
OA5	NC	0.67	0	NC	NC
OA6	NC	0.67	0.3	NC	NC
OA7	NC	0.67	0	NC	NC
OA8	NC	0.67	0	NC	NC
OA9	NC	0.67	0	NC	NC
OA10	NC	0.67	0	NC	NC
OA11	NC	0.67	0	NC	NC

Shortnose Sturgeon

Food (C_F) = minimum SI of V_1, V_2, or V_3

Reproduction (C_R) = minimum SI of V_4, V_5, or V_6

HSI = mimum of SI for C_F or C_R

Site	C_F	C_R	HSI
HD1	0.9	0	0
HD2	1	0	0
OA1	0.8	0	0
OA2	0.8	0	0
OA3	0.8	0	0
OA4	0.8	0	0
OA5	0.82	0	0
OA6	1	0.3	0.3
OA7	1	0.3	0.3
OA8	1	0.3	0.3
OA9	1	0.3	0.3
OA10	1	0.3	0.3
OA11	1	0.3	0.3

APPENDIX D

FLOW DATABASE

EWWTP RECEIVING WATER UPSTREAM FLOW OBSERVATIONS

Weekly sample monitoring date in bold

Date	Time	Rain Event	R-1	A-1	A-4	A-9	Continuous?
01/01/2002	0908		---	---	**flow**	---	YES?
01/02/2002	0910	01/02/2002	**flow**	---	**flow**	---	**yes**
01/03/2002	1250		**flow**	---	**flow**	---	**yes**
01/04/2002	1335		---	---	**flow**	---	YES?
01/07/2002	1045	01/06/2002	**flow**	no access	**flow**	**flow**	**yes**
01/08/2002	0920		**flow**	---	**flow**	**flow**	**yes**
01/09/2002	1300		no flow -stand	no flow	**flow**	**flow**	No
01/10/2002	1300		no flow -stand	no flow	**flow**	**flow**	No
01/11/2002	1415		no flow -stand	no flow	**flow**	**flow**	No
01/14/2002	1300		no flow -stand	no flow	**flow**	**flow**	No
01/15/2002	1300		no flow -stand	no flow	**flow**	**flow**	No
01/16/2002	1645		no flow -stand	no flow	no flow	no flow	No
01/21/2002	1333		no flow -stand	---	---	---	No
01/28/2002	1415	01/28/2002	no flow -stand	no flow -stand	**flow**	**flow**	No
01/29/2002	1345		no flow -stand	no flow -stand	**flow**	**flow**	No
01/30/2002	1610		no flow -stand	---	**low flow**	**low flow**	No
01/31/2002	1220		no flow -stand	---	**low flow**	**low flow**	No
02/01/2002	1315		no flow -stand	---	**low flow**	**low flow**	No
02/04/2002	1430		no flow -stand	----	**trickle**	no flow	No
02/05/2002	1400		no flow -stand	----	no flow	----	No
02/19/2002	1045		No flow	----	**low flow**	**Very low flow**	No
02/20/2002	1400		No flow	----	**low flow**	**low flow**	No
02/21/2002	1500		No flow	----	**low flow**	**low flow**	No
02/22/2002	1535		No flow	----	no flow	no flow	No
03/07/2002	1410		No flow	no flow	**flow**	**flow**	No
03/08/2002	1425		No flow	no flow	**low flow**	**low flow**	No
03/11/2002	1400		No flow	**low flow**	**low flow**	----	No
11/07/2002	1010	11/06/2002	No Flow-Stand	no flow -stand	no flow -stand	no flow	No
11/08/2002	1510	11/07/2002	No Flow-Stand	no flow -stand	no flow -stand	no flow	No
11/11/2002	1354	11/10/2002	No Flow-Stand	no flow -stand	no flow -stand	no flow	No
12/13/2002		12/13/2002	No Flow-	**no flow**	**no flow**	no flow	No
12/16/2002	930	12/16/2002	**flow**	**flow**	**flow**	**flow**	**yes**
12/17/2002	1000		**low flow**	**low flow**	**low flow**	**low flow**	**yes**
12/18/2002	1530		no flow		**no flow**	no flow	No
12/19/2002	1630	12/19/2002	**flow**	**flow**	**flow**	**flow**	**yes**
12/20/2002	1400	12/20/2002	**flow**	**flow**	**flow**	**flow**	**yes**
12/23/2002	1705	12/20/2002	no flow		no flow		no
12/26/2002	1505	12/25/2002	**low flow**	**low flow**	**low flow**	**low flow**	**yes**
12/27/2002	1135	12/26/2002	**low flow**	**low flow**	**low flow**	**low flow**	**yes**
12/30/2002	1425	12/28/2002	No Flow-Stand		**low flow**	**low flow**	**yes**
12/31/2002	1135		**low flow**		**low flow**	**flow**	**yes**
01/01/2003	1430		**low flow**		**flow**	**flow**	**yes**
01/03/2003	935		**no flow**				no
01/08/2003	915		No Flow-Stand				no
01/10/2003	1250	01/09/2003	**flow**	**flow**	**flow**	**flow**	**yes**
01/13/2003	1605		**flow**	**flow**	**flow**	**flow**	**yes**
01/14/2003	830		no flow	no flow	**low flow**	**low flow**	no
01/20/2003	1320		no flow		no flow	**low flow**	no
01/21/2003	846	01/20/2003	**flow**	**flow**	**low flow**	**low flow**	**yes**
01/22/2003	1240	01/21/2003	**flow**	**flow**	**flow**	**flow**	**yes**
01/23/2003	1240	01/22/2003	**low flow**	**flow**	**flow**	**flow**	**yes**
01/24/2003	1530	01/23/2003	no flow	**flow**	**flow**	**flow**	no
02/17/2003	1240	02/15/2003	no flow	no flow	no flow	no flow	no
02/19/2003	1105	02/18/2003	no flow	no flow	no flow	no flow	no
03/14/2003	1430	02/13/2003	no flow	no flow	no flow	**flow**	no
03/20/2003	1315	03/19/2003	no flow		no flow	no flow	no
04/03/2003	725	04/02/2003	no flow		no flow		no
04/04/2003	745	04/03/2003	no flow		no flow		no

--- Indicates no observation made

Bold-Orange highlight indicates dates with continuous flow

CITY OF VACAVILLE
Easterly Wastewater Treatment Plant
DISCHARGE MONITORING REPORT

WET SEASON RECEIVING WATERS DATA 2001-2003

YELLOW-HIGHLIGHT INDICATES FLOW PRESENT AT R-1 STATION

STATION DESCRIPTION			R-1		R-1		R-1		R-1		R-1		R-2		R-2
CONSTITUENT NAME			FLOW		NH4-N		NH3 - UNION		NITRATE-N		BOD		NH3-N		NH3 - UNION
UNITS			MGD		MG/L		MG/L		MG/L		MG/L		MG/L		MG/L
SAMPLE TYPE			MEASURE		GRAB		GRAB		GRAB		GRAB		GRAB		GRAB
FREQUENCY			WEEKLY		MONTHLY		MONTHLY		MONTHLY		MONTHLY		MONTHLY		MONTHLY
MONTH	DAY	*		*		*		*		*		*		*	
April 2001	5		(3)		(3)		(3)		(3)		(3)	1	0.2	1	<0.01
April 2001	11		(3)		(3)		(3)		(3)		(3)	1	0.1	1	<0.01
April 2001	19		(3)		(3)		(3)		(3)		(3)	1	0.1	1	<0.01
April 2001	26		(3)		(3)		(3)		(3)		(3)	1	0.2	1	<0.01
November 2001	1		(3)		(3)		(3)		(3)		(3)	1	0.3	1	<0.01
November 2001	7		(3)		(3)		(3)		(3)		(3)	1	0.2	1	<0.01
November 2001	14		(3)		(3)		(3)		(3)		(3)	1	0.2	1	<0.01
November 2001	19		(3)		(3)		(3)		(3)		(3)	1	<0.1	1	<0.01
November 2001	27		(3)		(3)		(3)		(3)		(3)	1	0.2	1	<0.01
December 2001	6		(3)		(3)		(3)		(3)		(3)				
December 2001	11		(3)		(3)		(3)		(3)		(3)	1	0.2	1	<0.01
December 2001	19		(3)		(3)		(3)		(3)		(3)				
December 2001	26		(3)		(3)		(3)		(3)		(3)				
January 2002	3	1	Low	1	0.1	1	<0.01	1	0.6	1	6	1	0.4	1	0.004
January 2002	8	1	Low					1	0.5						
January 2002	16		(3)		(3)		(3)		(3)		(3)				
January 2002	21		(3)		(3)		(3)		(3)		(3)				
January 2002	28		(3)		(3)		(3)		(3)		(3)				
February 2002	5		(3)		(3)		(3)		(3)		(3)	1	0.1	1	0.001
February 2002	13		(3)		(3)		(3)		(3)		(3)				
February 2002	19		(3)		(3)		(3)		(3)		(3)				
February 2002	26		(3)		(3)		(3)		(3)		(3)				
March 2002	5		(3)		(3)		(3)		(3)		(3)	1	0.2	1	0.002
March 2002	12		(3)		(3)		(3)		(3)		(3)				
March 2002	19		(3)		(3)		(3)		(3)		(3)				
March 2002	28		(3)		(3)		(3)		(3)		(3)				
April 2002	3		(3)		(3)		(3)		(3)		(3)	1	1.0	1	0.010
April 2002	10		(3)		(3)		(3)		(3)		(3)				
April 2002	18		(3)		(3)		(3)		(3)		(3)				
April 2002	25		(3)		(3)		(3)		(3)		(3)				
November 2002	5		(3)		(3)		(3)		(3)		(3)	1	0.3	1	0.003
November 2002	12		(3)		(3)		(3)		(3)		(3)				
November 2002	19		(3)		(3)		(3)		(3)		(3)				
November 2002	25		(3)		(3)		(3)		(3)		(3)				
December 2002	3		(3)		(3)		(3)		(3)		(3)	1	0.3	1	0.003
December 2002	10		(3)		(3)		(3)		(3)		(3)				
December 2002	17	1	Low	1	0.2	1	0.0	1	0.6	1	<3				
December 2002	24		(3)		(3)		(3)		(3)		(3)				
January 2003	2		(3)		(3)		(3)		(3)		(3)				
January 2003	8		(3)		(3)		(3)		(3)		(3)	1	<0.1	1	<0.001
January 2003	14		(3)		(3)		(3)		(3)		(3)				
January 2003	21	1	Very Low	1	<0.1	1	<0.001	1	0.4	1	5.4				

CITY OF VACAVILLE
Easterly Wastewater Treatment Plant
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CONSTITUENT NAME			FLOW		NH4-N		NH3 - UNION		NITRATE-N		BOD		NH3-N		NH3 - UNION
UNITS			MGD		MG/L		MG/L		MG/L		MG/L		MG/L		MG/L
SAMPLE TYPE			MEASURE		GRAB		GRAB		GRAB		GRAB		GRAB		GRAB
FREQUENCY			WEEKLY		MONTHLY		MONTHLY		MONTHLY		MONTHLY		MONTHLY		MONTHLY
MONTH	DAY	*		*		*		*		*		*		*	
January 2003	28		(3)		(3)		(3)		(3)		(3)				
February 2003	4		(3)		(3)		(3)		(3)		(3)				
February 2003	11		(3)		(3)		(3)		(3)		(3)	1	0.4	1	0.004
February 2003	18		(3)		(3)		(3)		(3)		(3)				
February 2003	25		(3)		(3)		(3)		(3)		(3)				
March 2003	4		(3)		(3)		(3)		(3)		(3)	1	0.4	1	0.004
March 2003	11		(3)		(3)		(3)		(3)		(3)	1	0.5	1	0.005
March 2003	18		(3)		(3)		(3)		(3)		(3)				
March 2003	25		(3)		(3)		(3)		(3)		(3)				
MONTHLY AVERAGE					0.2		<0.01		0.5		6		0.3		0.004
MONTHLY HIGH					0.2		<0.01		0.6		6		1.0		0.010
MONTHLY LOW					0.1		<0.01		0.4		5		0.1		0.001
TOTAL RECORDINGS MO			4		3		3		4		3		20		20
REQUIREMENT #1													30D <0.5		
TIMES EXCEEDED													0		
REQUIREMENT #2															
TIMES EXCEEDED															
REQUIREMENT #3															
TIMES EXCEEDED															

* NUMBER OF SAMPLES EACH DAY

(3) No Flow at R - 1 Station